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EXPOSURE TO ONLINE NEWS AND POLARIZATION OF XENOPHOBIC ATTITUDES:

A QUANTITATIVE ANALYSIS OF SURVEY DATA IN JAPAN AND THE U.S.

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Abstract

Many scholars and journalists have raised the possibility that the Internet expands the divide in public opinion and society by polarizing people's opinions about political issues. Selective exposure to news and civic information is more likely to occur on the Internet than in the mass-media-centered environment of the past. This study focused on cyber-racism, such as the "Alt-Right" in the U.S. and "Netto-uyoku" in Japan. We examined the relations between the polarization of xenophobic attitudes and the frequency of exposure to online news on PCs/smartphones. We used data from online questionnaire surveys conducted in the U.S. and Japan in 2016. The results of quantile regression analyses showed that in Japan exposure to online news via PCs significantly expanded the polarization of users' attitudes, whereas in the U.S. it shifted the attitudes uniformly toward an anti-xenophobic direction. These findings suggest that social, political, and cultural contexts influence the occurrence of opinion polarization on the Internet.

Key words: opinion polarization, cyber racism, selective exposure to information, quantile regression analysis

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1. The Problem of Xenophobia and the Internet

In recent years, the rise of xenophobic nationalism in developed countries has garnered much attention worldwide. In 2016, the U.K. decided to leave the EU in a referendum due to a strong reaction toward the increase in the country's immigrants and refugees from Eastern Europe and the Middle East. In the U.S. presidential elections, Donald Trump, who explicitly stated xenophobic assertions, upset most expectations and became President. Extreme right parties and candidates who advocate anti-immigration policies are gaining votes in the presidential and general elections of France, Germany, the Netherlands, and Austria.

It is often stated that the Internet is promoting the expansion of xenophobia in relation to political trends. In the U.S., the "Alt-Right," which gained attention in the recent presidential election, is a symbolic example. Ikeda (2017: 185) states that the activities of those who advocate white supremacy are "limited mainly to the Internet;" but, "it is not just something that can be handled lightly," because "the speed in which discourse disseminates on the Internet is far from what it used to be, and it is easy to form one's own convictions regardless of the truth of the discourse."

Japan's Alt-Right is called "Netto-uyoku." Their presence on the Internet began to stand out in the early 2000s, and around 2006, they began to feature in major newspapers. Their activities gradually moved offline, and hate demonstrations took place on the streets (Yasuda 2012). This movement resulted in the Hate Speech Elimination Law, which was passed by the National Diet in 2016.

Formerly, it was not easy for these exclusionists to disseminate their claims widely to the public and mobilize participants to join their activities. Leading media companies do not tend to repeat their extreme speech, and it is costly for exclusionists to prepare media on their own to spread their claims. The expansion of the Internet has changed that situation. The role of the Internet in mobilizing xenophobic speech and activity has been confirmed in interviews and surveys with activists in empirical studies conducted in Japan and overseas (Higuchi 2014, Perry & Scrivens 2016).

Is information exposure on the Internet strengthening the xenophobic attitudes and opinions of the non-activist, general public? There are many more xenophobic opinions and commentaries on the Internet than there were in the old mass media-centric information environment, and exposure is easier. It appears to suffice just considering the possibility of that kind of utilization. Intuitively, the relationship seems to work naturally. Many critics who view the Internet as a danger have assembled discussions on that point as a semi-implicit premise.

However, there is also much information and criticism on the Internet that convey the serious harm caused by xenophobic movements. It may be enough to consider the possibility that they seek to neutralize the influence of the xenophobic discourse. However, based

on the prevailing views of current studies on the Internet (detailed in Section 2), further possibilities can be envisioned. Those who originally were sympathetic toward xenophobia become exposed to the information conforming to their own predispositions, which can lead to an intensification of the xenophobic attitude. Meanwhile, those who have a pre-existing critical attitude toward xenophobia, by making selective contact with the information they prefer, further strengthen their anti-xenophobia attitude. Thus, the Internet can exert so-called "polarization."

There are only a few quantitative survey researches on xenophobia and nationalism that have examined the effects of the Internet on both Japan and abroad,[1)] and none of them assumed the possibility of "polarization" effects. Hence, this study analyzes how news exposure on the Internet relates to users' xenophobic attitudes based on web survey data conducted in Japan and the U.S.

Section 2 provides an overview of previous research on the mechanism by which the "polarization" effect occurs, and Section 3 pinpoints the methodological problems in existing research and presents a new alternative: the application of quantile regression.

2. The Internet and the "Polarization" of Attitudes and Opinion

People have a predisposition to be selective about the news and information they consume. This fact was revealed more than half a century ago. Lazarsfeld et al. (1948) conducted a survey on the 1940 U.S. presidential election, and the majority of voters who were Republicans were exclusively in touch with the Republican election campaign, and the same was true for Democrat voters.

At present, selective exposure to information on the Internet has become much easier than it would have been during the age of mass media. The constitutional scholar Cass Sunstein was the first to express concern over this situation (Sunstein 2000, 2017). The process by which the public balances and discusses diverse opinions is important for democracy. However, the acceleration of selective exposure to information on the Internet may erode the foundation of democratic public opinion formation. Information-filtering technology used in social media, such as Facebook, can further increase the risk; for instance, the development of the "filter bubble" on the web automatically selects and presents news according to a user's preference (Paliser 2011).

The computational social scientists Del Vicario et al. (2016), who analyzed information dissemination on Facebook, clarified that users' networks are differentiated into 2 clusters: one that prefers scientific news, and another that prefers conspiracy news, both of which occur through selective exposure to information. Scientific and conspiracy news are distributed

1) As far as we can see, there is only 1 observable case from Hyun et al. (2014) abroad; in Japan, it is only in the studies of Tsuji (2009, 2017) and Taka (2015).

exclusively in homogeneous clusters of respective preferences, and each cluster has less exposure to the other type of news. Users with similar attitudes and opinions form a closed network where only specific types of information circulate and are amplified. It is the "echo chamber" effect.

Communication divided into homogenous subgroups (clusters) shows a tendency for "group polarization" of attitudes and opinions. This process was repeatedly confirmed in experimental studies in social psychology even before the appearance of the Internet (Arima 2012). For example, if a group discusses a certain topic and the average value of the group's opinion was originally in favor, then after the discussion, the group has a further tendency to gear toward the in-favor opinion. Likewise, in a group that originally opposes an opinion, there is a tendency to further opposition. Hence, when the in-favor and opposing sides divide and have discussions separately, they will each be biased toward the extremes, overall. At the level of each subgroup (part), attitudes and opinions intensify at the opposite ends of the pole, and the differentiation into two poles at the overall level is called group polarization.

Several experimental studies have found that group polarization is more likely to occur in computer-mediated communication (CMC) situations, such as on the Internet, than in face-to-face situations (Spears et al. 1990, Latané & L'Herrou 1996, etc.).[2)] In the echo chamber on the web, group polarization online — a "cyber cascade" (Sunstein 2017) — is likely to progress more rapidly. As a result, the division of public opinion and confrontations in society can intensify.

In the age of mass media, the researchers focused on the media's influence to change public opinion uniformly in one direction. Presently, the composition of the polarization effect, the problem of the Internet age, is more complicated. The Internet can make each cluster within its echo chamber have stronger attitudes and opinions that lean in a specific direction *even more than* mass media could. It aggregates and differentiates the whole population into a distribution of attitudes and opinions on two poles, *unlike* mass media. The meaning of "polarization" differs at the part/whole levels, which is where it gets confusing.

The polarization of attitudes and opinions on the Internet is often explained as "confirmation bias" (Klayman & Ha 1987). Those with preconceptions, prejudices, and stereotypes are likely to pay attention to the information and examples that match them, and they will ignore those that do not match (Snyder and Swann 1978). This phenomenon is confirmation bias, and it is more likely to work in the echo chambers of the Internet by facilitating access to information consistent with one's own predispositions. Original attitudes and opinions are further

2) However, these studies do not argue that CMC is prone to group polarization from a technologically deterministic point of view. For example, Spears et al. (1990) consider group membership in a CMC situation to promote conformity with group norms (de-individualization) and cause group polarization phenomena (SIDE theory). This seems to be a suggestive view that can also be applied in situations where xenophobia is a problem (a situation where in-group membership is emphasized relative to outside the group), as in this study.

strengthened, and polarization occurs.[3)] In fact, the results of the online field experiments conducted by Knobloch-Westerwick et al. (2015), show that selective exposure is observed in news searches on the web and that attitudes are strengthened by confirmation bias.

3. Developing a New Appropriate Methodology to Analyze Polarization

There are relatively few analyses of social survey data in empirical studies on the polarization of attitudes and opinions on the Internet. Many of these studies set up controlled experimental condition situations. However, the results obtained from controlled situations do not necessarily reflect actual situations. Therefore, verification based on survey data is necessary. For selective exposure to information on the Internet, which is a prerequisite for polarization, there are many cases where the findings obtained from a controlled situation were not confirmed in the survey (Iyenger et al. 2008).

There have been a few recent attempts to identify causality using longitudinal panel survey data, such as in Barberá (2015) and Boxell et al. (2017). In one cross-sectional survey, if there was a link between Internet usage and polarization of attitude, whether it was <Internet usage leads to → polarization of attitude> or <the more extreme an attitude a person holds → the more frequent his or her Internet usage to access information that matches his or her preferences>, the direction of causality was not clear. Barberá's (2015) study suggests an interesting causal effect: the use of social media encourages moderation rather than the polarization of political attitudes. However, when the study constructed the indicator variables of polarization, it used the "folding" method, which has problems, as discussed below. Hence, doubts remain in the validity and reliability of the study's analysis results. The problem is also deeply connected to the difficulties inherent in the analysis of polarization by survey data. This issue will be explained in order.

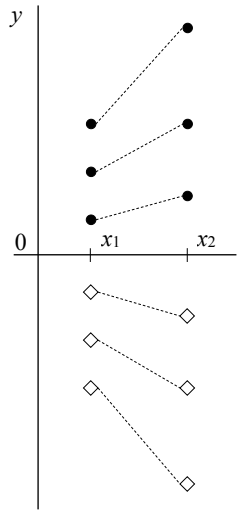

FIGURE 1.
Schematic of Polarization

For the sake of simplicity, consider a simple case in which the attitude Y is polarized only by factor X, as shown in Figure 1. For example, whether the Y-axis is against accepting immigrants (+direction) or in favor (-direction), it indicates the positive or negative opinion and its degree. It is assumed that the X-axis is the frequency of exposure with news on the Internet (x_2 is higher in frequency than x_1). Figure 1 indicates that the higher the frequency

3) Confirmation bias theory has the advantage of being able to explain why information is easily received and diffused in specific groups, even in the case of "fake news," which is wildly unreliable (Quattrociocchi 2017). This point is hard to explain in group polarization theory. It can be an important perspective in pursuing research on the current "post-truth" phenomenon.

of news exposure, the more divided the opinion of the target group is against/in favor of accepting immigrants.

In general, OLS (ordinary least squares) regression analysis is used when the value of the dependent variable y is defined and predicted by the independent variable x. Assuming that the regression coefficient of x is a, the intercept is b, and the error factor is e, the equation that defines y is expressed as

$y_i = ax_i + b + e_i$

In this case, what defines a change in the value of independent variable x is the change in the average value of dependent variable y. However, in Figure 1, the average value of y at x_1 and its average value at x_2 do not change ($\bar{y_1} = \bar{y_2}$). What changes is based on the value of x, which is the variance, not the average value of y. OLS regression analysis is not used to define and predict changes in the variance of the dependent variable y due to independent variable x. This is the first problem.[4)]

The solution to this problem, which is almost the current de facto standard, is to construct a dependent variable that means the degree of polarity by "folding" the value of the dependent variable at a reference point, such as the median or mean value (Brannon et al. 2007, Wojcieszak & Rojas 2011, Lee et al. 2014, Barberá 2015, Lee 2016, Boxell et al. 2017). In Figure 1, variable y' is formed by an absolute value conversion with y=0 as the reference point. The value of y' increases as the attitudes and opinions towards immigration acceptance become stronger and more extreme, whether they are in favor or against. Through this operation, Figure 1 is converted into Figure 2, and OLS regression analysis is performed.

Since independent variable x changes the *average value* of y' (degree of polarity), the first problem is avoided. However, a second problem remains. If attitude and opinion y is polarized due to the frequency of news exposure on the Internet x, it could be assumed that the influence of news exposure frequency x is harder to accept as the original preconceived tendency on immigration acceptance becomes neither in favor nor against (as y or y' becomes closer to 0). The motivation to selectively connect with information that is neither in favor nor against is small, and the possibility of being in that environment is less likely.

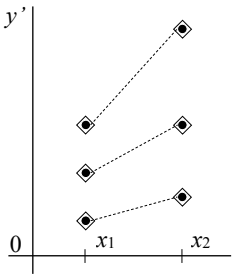

FIGURE 2.
"Folding" conversion of the dependent variable

Figures 1 and 2 assume such a case. Hence, even in Figure 2, the variance of y is larger in x_2 than in x_1. The fact that the variance of dependent variable y' changes with independent variable x means that the error term e changes along with independent variable x in the

4) From a perspective that partially overlaps with our study, Rodrigo & Ato (2002) point out methodological problems in previous studies that analyzed group polarization. However, their proposed alternative is an analysis method that assumes data obtained from an experimental situation, which is difficult to apply to the social survey data our study uses.

previous regression equation. In OLS regression analysis, the precondition is that independent variable *x* and error term *e* are independent (unrelated) of each other. Figure 2 violates this assumption, and proper estimation may not be possible with OLS regression analysis.

In this study, quantile regression analysis is used to overcome the problems described above. For a summary of the statistical explanation and application of quantile regression, please refer to Hao & Naiman (2007). Here, only the essential points will be explained.

In OLS regression, one assumes a multivariate normal distribution of dependent variables and estimates the mean value from the independent variables, whereas in quantile regression, arbitrary quantiles can be inferred without assuming a specific distribution, such as 10th percentile, 25th percentile (1st quartile), 50th percentile (median value), and so on. For example, in Figure 1, the upper end of the distribution of the dependent variable *y*, that is, the people with a strong xenophobic attitude, is estimated by quantile regression, aiming at the 90th percentile point, 75th percentile point, etc. The coefficient value of independent variable *x* is positive, and the coefficient value of the 90th percentile point is larger than the coefficient value of the 75th percentile point. Conversely, the lower end of the distribution of *y* (the people with a strong anti-xenophobic attitude) is inferred by the 10th percentile point, 25th percentile point, and so on. The coefficient value of *x* is negative, and the absolute value of the coefficient is larger at the 10th percentile point than at the 25th percentile point. By comparing the analysis results of multiple quantiles, it is possible to examine how the distribution (variance) of dependent variable *y* changes depending on independent variable *x*.

To the authors' knowledge, there are no studies using quantile regression to analyze the polarization of attitudes. This study will be the first.

4. Survey Data and Variables Used for Analysis

The data collected from a self-administered web survey questionnaire conducted in Japan and the U.S. was used for the analysis. Among the registered monitors of web research companies in each country, the subjects were 15- to 69-year-old residents of metropolitan areas (Tokyo and New York). The target number of samples collected was assigned in proportion to the population distribution of gender and 10-year age division for each country. The survey period was September 23 to October 3, 2016 in Japan, and September 21 to October 11, 2016 in the U.S. The number of collected samples was 1000 for both countries, and the number of valid responses after data cleaning was 951 in Japan and 987 in the U.S. Please refer to Kitamura et al. (2018) for the details of the survey.

Below is an analytical model assuming that a change in the xenophobic attitude (polarization) occurs due to exposure to Internet news. As mentioned in the previous section, the causality of this direction has not been confirmed in previous studies; however, this issue is not limited to polarization research. It is less important to identify causal direction if no relationship between

the variables is observed. Thus, the general research procedure usually starts with examining whether expected relations can be observed before it moves on to more difficult causal identifications. This study's analysis is the first step to future causality estimations, based on the appropriate methods.

For the dependent variables, the answers to 8 questions on xenophobic attitudes were analyzed into their principal components. We used the 1st principal score obtained. As presented in Table 1, the principal component loading for each item shows similar patterns in Japan and the U.S. These 8 items were adopted from the 2013 National Identity Survey of the International Social Survey Program (ISSP). They are some of the most commonly asked questions in quantitative studies on nationalism.

TABLE 1.

Results of the principal component analysis of 8 xenophobic attitudes (load quantity)

	JAPAN	U.S.
1. Immigrants increase crime rates.	.39	.40
2. Immigrants are generally good for Japan's/America's economy.	-.37	-.36
3. Immigrants take jobs away from people who were born in Japan/America.	.33	.41
4. Immigrants improve Japanese/American society by bringing new ideas and cultures.	-.41	-.38
5. Japanese/American culture is generally undermined by immigrants.	.41	.34
6. Legal immigrants to Japan/America who are not citizens should have the same rights as Japanese/American citizens.	-.38	-.24
7. Japan/America should take stronger measures to exclude illegal immigrants	.19	.38
8. Legal immigrants should have equal access to public education as Japanese/American citizens	-.29	-.28
Eigenvalue	2.69	3.43

For the independent variable, we use the frequencies of news exposure on the Internet using a "PC/tablet" and a "smartphone/cellphone." Past studies by Tsuji (2017) and Taka (2015) used total Internet usage time. Since a considerable amount of this time may include usage for associating and interacting with friends, it is not applicable as an indicator of information exposure, which is the focus of polarization research.[5)] The former will be referred to as the "PC Internet news exposure" scale, and the latter will be the "MB Internet news exposure" scale. The questionnaire had 6 questions regarding how much the respondents use the PC/MB to "watch and read" each of the 3 news genres: "society," "international," and "politics." They were marked in descending order of frequency on a scale of 6 to 1. The answers to these 3 questions were summed up to construct a "frequency of Internet news exposure on a PC/MB" scale. Cronbach's α, an indicator of the internal consistency of the scale, was 0.96 in Japan/0.80 in the U.S. for the PC Internet scale, and 0.97/0.90 respectively for the MB Internet scale.

5) News exposure may also be a side effect of using the Internet for social exchange purposes. However, secondary news exposure is included since the question to be taken as an independent variable is: "How long do you watch and read the following news on the Internet?"

Control variables include: the demographic variables of the respondents (gender, age, academic background, household income, and ethnicity for the U.S. only), frequency of news exposure through TV/newspaper, and 3 variables, namely: general trust, tolerance, loneliness (solitude), which are indicated among the psychological tendencies of individuals with xenophobic attitudes, as pointed out in previous research (Kim 2015, Tsuji 2017, etc.).

TABLE 2.
Descriptive statistics of each variable used for analysis

	JAPAN			U.S.		
	Range	*Mean*	*SD*	*Range*	*Mean*	*SD*
Xenophobic attitude principal component score	-3.36~3.87	0	1	-2.20~2.95	0	1
Gender dummy (Male)	0~1	0.49	0.50	0~1	0.50	0.50
Age	15~69	43.98	14.95	15~69	41.34	15.37
Education	2~6	4.46	0.92	1~6	4.62	1.08
Household annual income (Million¥ / 10,000$)	1~16	5.95	3.89	1.75~16	7.67	4.50
Ethnicity dummy (Caucasian)	---	---	---	0~1	0.72	0.45
General trust	3~15	8.93	2.25	3~15	10.38	2.78
Tolerance	1~5	2.96	0.97	1~5	3.05	1.24
Loneliness	3~15	7.77	2.92	3~15	7.65	3.71
News exposure frequency: TV	1~6	5.14	1.43	1~6	4.93	1.40
News exposure frequency: Newspaper	1~6	3.26	1.99	1~6	3.59	1.62
News exposure frequency: PC Internet	3~18	12.30	5.35	3~18	11.70	4.42
News exposure frequency: MB Internet	3~18	9.23	5.96	3~18	10.05	5.29

A dummy variable is used for gender, with 1 for male and 0 for female. Academic background is set as 1-6 for graduating (or currently attending) “elementary school;” “junior high;” “senior high;” “junior college, technical college, vocation school;” “university;” or “graduate school.” Household annual income is divided into 8 categories of “less than 2 million yen” to “over 14 million yen,” for Japan/ 10 categories of “less than $35,000” to “more than $140,000” in the U.S. For each category, a median value is assigned (“over 14 million yen” and “more than $140,000” are converted to 16 million yen and $160,000, respectively). In the U.S., the ethnicity variable is set to 1 for “White or Caucasian” and 0 for all others. The frequency of news exposure through TV/newspaper is set as 6 to 1 for “several times a day” to “do not watch or read.”

The following 3 items were given for the psychological scale of general trust (Yamagishi 1998): “most people are basically honest,” “most people are trustworthy,” and “most people are trustful of others.” For each item, the answers included “I think so” to “I do not think so” and were assigned values from 5 to 1. A summed-up scale variable was constructed (Japan α=.78/ U.S. .84). To arrive at the variable of intolerance of others who are different, we reversed the answer value to the item “I don’t really want to socialize with people whose

values differ from my own." For loneliness, the Japanese version of the UCLA Loneliness Scale (Moroi 1991) was used; the three items include: "I lack companionship," "There is no one I can turn to," and "People are around me but not with me" were asked and summed up (α=.78/.83).

Quantile regression analysis is performed using the above variables (see Table 2 for the descriptive statistics of each variable). In addition to the 25/50/75 percentiles, the quantile point of the assumed dependent variable is the group of "Netto-uyoku"—who strongly hold xenophobic attitudes—as operationally defined in Tsuji (2017). It is about 2% of the sample and set to the 90/95 percentile at the top of the distribution and the 5/10 percentile at the bottom. The bootstrap method was used to estimate the standard error. According to Hao & Naiman (2007), since the number of re-samplings to estimate the standard error with the bootstrap method is 500-2000 as a standard, it is set to 2000 times. To ensure that the results can be replicated, the initial value of the random number generator is set to 1,234,567. Stata 15.1 was used for the analysis.

5. Results

Tables 3 and 4 show the results of the quantile regression analysis for Japan and the U.S., respectively. For reference, the result of the OLS regression analysis using the principal component score of xenophobic attitude as the dependent variable and the result of using the absolute value converted into polarity score (see Section 3) as the dependent variable are appended.

First, let's observe the effect of the control variables. In Japan, a positive effect of being male linked to a xenophobic attitude is observable in many quantiles. In the U.S., age, ethnicity (Caucasian), and household income have a positive effect, while educational background showed a negative effect. These effects can also be observed from OLS regression analysis using a raw score as a dependent variable. For the variables of the psychological tendencies, for both countries, general trust and tolerance are negative in most of the quantiles, while loneliness is positive in most of the quantiles. These findings are consistent with those in previous studies.

The frequency of news exposure through TV has no significant effect on almost any quantile in either country. The same is true for newspapers. However, in the results of the OLS regression analysis in the U.S., significant positive effects can be observed. In the U.S., the conversion of newspapers to partisan media has often been mentioned in recent scholarship. These results can mean that individuals often can consume newspapers geared toward their own partisanship.

TABLE 3.

Results of quantile regression/OLS regression: Japan

	Quantile regression							OLS regression	
(n=951)	q.05	q.10	q.25	q.50	q.75	q.90	q.95	raw score	polarity score
(constant term)	-.450	-.188	.191	.816**	1.647***	2.957***	4.113***	1.137***	.986***
Gender dummy	.306†	.258†	.121	.190**	.106†	-.087	.044	.167*	-.017
Age	.002	.001	-.004	-.003	.000	-.003	-.008	-.001	.001
Education	-.073	-.077	.025	.015	-.010	.054	-.139	-.020	-.012
Household income	-.024	-.020	.000	-.005	-.008	.005	.004	-.005	.001
General trust	-.069	-.024	-.050*	-.060***	-.065***	-.160***	-.190***	-.075***	-.031**
Tolerance	-.196***	-.205***	-.205***	-.176***	-.218***	-.346***	-.208†	-.213***	.008
Loneliness	.030	.045*	.067***	.043***	.018	.012	.006	.038***	-.017*
News exposure: TV	.062	.010	-.007	.013	-.010	.002	.011	.004	-.005
News exposure: Newspaper	.052	.025	.013	-.018	-.016	-.018	-.003	-.008	-.017
News exposure: PC Internet	-.030*	-.023†	-.001	.000	.002	.027†	.050**	.001	.010*
News exposure: MB Internet	.004	-.005	-.022*	-.010*	-.001	.009	.012	-.005	.008*
pseudo-R^2 / adj.R^2	.086	.076	.075	.069	.059	.096	.112	.102***	.019*

Notes: significance level; *** p<.001, ** p<.01, * p<.05, † p<.10

TABLE 4.

Results of quantile regression/OLS regression: U.S.

	Quantile regression							OLS regression	
(n=987)	q.05	q.10	q.25	q.50	q.75	q.90	q.95	raw score	polarity score
(constant term)	-1.996***	-1.519**	-.878*	.361	1.326***	1.840***	2.856***	.329	1.534***
Gender dummy	.061	.150	.156	.088	.052	.088	.040	.116†	-.022
Age	.011*	.012*	.009*	.009**	.011***	.016**	.007	.011***	.000
Education	-.132†	-.188*	-.151***	-.158***	-.126***	-.075	-.087	-.159***	.002
Household income	.021	.014	.023†	.016†	.021*	.009	.025	.021**	-.002
Ethnicity dummy	.356*	.558**	.410**	.369***	.215***	.343***	.476**	.371***	-.020
General trust	-.003	-.017	-.013	-.032*	-.051***	-.070***	-.058†	-.038**	-.024**
Tolerance	-.039	-.082	-.150**	-.137**	-.161***	-.195***	-.206**	-.155***	-.034*
Loneliness	.048*	.060*	.073***	.060***	.021*	.012	-.014	.043***	-.016**
News exposure: TV	.067	.073	.066†	.018	.012	-.033	.007	.035	-.043**
News exposure: Newspaper	.036	.066†	.090*	.042	.036	.055†	.039	.057**	-.014
News exposure: PC Internet	-.062***	-.068***	-.060***	-.036***	-.017	-.017	-.044*	-.039***	.009
News exposure: MB Internet	.019	.026†	.018	.009	-.006	-.008	-.016	.009	-.008
pseudo-R^2 / adj.R^2	.103	.123	.135	.097	.094	.137	.138	.174***	.039***

Notes: significance level; *** p<.001, ** p<.01, * p<.05, † p<.10

The results concerning the main topic, the frequency of news exposure on the Internet, are shown in Tables 3 and 4. In Japan, a negative effect with the significance of p<.05 or <.10 at the 5/10 percentile point is shown for PC Internet exposure, while a positive effect is shown at the 90/95 percentile point, as shown in Table 3. The absolute value of the coefficients also

increased as they reached both ends and a significant difference of $p<.05$ as a whole was observed at the coefficient values of the nine quantile points using the Wald test.[6] This result suggests that PC Internet news exposure has the (bi-) polarization effect of attitudes, namely, the people with stronger predisposition of xenophobia become even stronger, and likewise, the weaker people becomes even weaker.

Interestingly, contrasting results are observed for MB Internet news exposure. MB Internet exposure was found to have no significant effect on either end layers, and the median 25th percentile and 50th percentile showed significant negative effects. We can interpret this result as follows. Due to the differences of display size and operability between PCs and MBs (smartphones and mobile phones), the former is generally easier to use and thus facilitates selective access to information according to users' predispositions. Rather than selective exposure, if MBs are used *to consume news in general,* the result concerning MB Internet news exposure means the effect of such *news in general.*

Previous studies of mass media effects show that media is more likely to affect the audiences regarding issues which they are less involved in or which are less associated with their predispositions (Klapper 1957). Assuming that exposure to the news in general through MBs has the effect of promoting attitude changes toward anti-xenophobia, the effect will appear in people with neither xenophobic nor *anti*-xenophobic predispositions, i.e., in those who are located around the middle, the 50th percentile. However, this point cannot be verified from the survey data and is merely a hypothesis. A follow-up investigation will be a task for the future.

As shown in Table 4, in the U.S., news exposure through MB Internet has no significant effect on any quantile.[7] Meanwhile, news exposure through PC Internet shows a significantly negative effect on 5 of the 7 quantiles. The coefficient values in the other 2 quantiles are also negative. There is no significant difference in the coefficient values of each quantile as a whole, even with the Wald test. For the U.S., news exposure through PC Internet does not cause polarization of xenophobic attitudes. Rather, it has the effect of weakening xenophobic attitudes uniformly from both ends toward the center. These effects can be properly estimated by OLS regression. The analysis results may seem surprising when considering that the

6) Furthermore, when the difference of each coefficient value is compared in pairs, the coefficient value of the 5th percentile point has a significant difference with all quantile points other than the 10th percentile point. The coefficient value of the 10th percentile point has a significant difference with all quantile points other than the 5th. The same applies to the coefficient values of the 90/95 percentile points. A significant difference was also observed between the above and all other quantiles except with each other. However, the 90th percentile point has a $p<.10$ reference level difference with the 25-75th percentile points.

7) In the regression analysis of the U.S. data, MB Internet news exposure shows VIF=2.47, and PC Internet news exposure shows a relatively high value of VIF=2.03. The effects of MB Internet may not have been separated well. However, the results (coefficient values) for the independent and control variables that remain in the analysis without MB Internet have basically no significant change. In general, for VIF, 5 to 10 or more are taken as a measure of multicollinearity, but "in social survey data of individuals, the recommendation is a VIF of 2 or less by strict estimation" (Hayashi 2014: 96).

polarization of public opinions on the Internet is often pointed out in the U.S. However, note that this study utilized Internet users living in New York—a liberal, east coast metropolitan area—as subjects. Given the nature of this survey, there are some reservations as to whether the analysis results can be extended throughout the U.S.

Finally, here are some considerations for the validity of the OLS regression analysis using the polarity score. In the quantile regression of the Japanese data, news exposure through PC Internet showed a relatively clear polarization effect. News exposure with PC Internet shows significant coefficient values even in OLS regression analysis with polarity score as a dependent variable. In this case, it seems that polarization has been captured successfully. However, significant coefficient values are also shown for news exposures with MB Internet. Actually, according to the results of quantile regression analysis as mentioned above, the effect of MB Internet is a different pattern from polarization. Hence, OLS regression analysis using the polarity score as a dependent variable may lead to false inferences and conclusions; it may be a dubious methodology for validity.

6. Summary of Conclusions and Future Work

The analysis in the previous section suggests that in the Japanese data, news exposure through PC Internet has the effect of polarizing xenophobic attitudes and opinions. Few previous studies have examined the impact of the Internet on xenophobic attitudes, and previous research on the polarization effect of the Internet from social survey data is practically non-existent in Japan. Our findings from the analysis are important for filling in this gap.

However, no polarization effect was observed for news exposure through MB Internet. In the U.S. data, no polarization effect was observed for either PC or MB Internet news exposure. The information environment of the Internet does not define users' selective information exposure behavior in a technologically deterministic manner. It strongly suggests that information exposure behavior and its consequences (effects on the user) changes depending on the context of usage. That includes whether the news is accessed using a PC or a smartphone and the social, political, or cultural background of the user. Therefore, the findings in this study is negative for the "filter bubble" hypothesis, where information conforming to the users' preference is automatically selected on the web, and as its consequences the user *passively* experiences the effects of the polarization of attitudes and opinions.[8)] Rather, researchers should observe more closely a role of the context of specific usage and the social, political, and cultural backgrounds on how users' *active* selection of information leads to the

8) This finding of our study are consistent with the study of Bakshy et al. (2015). They analyzed big data obtained from Facebook, and found that a user's individual behavior of selection was more closely related to the selective exposure of information rather than news feeds due to algorithmic ranking.

polarization of their attitudes. This study clarifies the interaction between information behavior and the socio-cultural context around it, which means there is a large area sociologists and social psychologists can research.

Since the survey used in this study was not originally designed to examine the effect of the Internet on xenophobic attitudes, the variables (questions) available for analysis were limited. For example, the survey lacks questions on selective exposure to information and news. Our analysis is in line with the process assumed by polarization theory and remains inadequate. If the polarization of attitudes and opinions comes from information exposure through PC Internet, it is necessary to study whether it is due to "confirmation bias," cited in Section 2; the "mere exposure effect" (Zajonc 1968), which refers to repeated exposure to homogeneous information in the echo chamber; or a "spiral of silence" (Noelle-Neumann 1993), where the recognition of opinion distribution in the surroundings (or society as a whole) is biased.

The biggest issue is, as mentioned in Section 4, the verification of causality. In this study, we discussed the theoretical problems of OLS regression analysis using the polarization index variable by the "folding" method. We showed that there are cases where it may actually lead to false inferences and conclusions (as in the effect of MB Internet usage in the analysis of the Japanese data). In this regard, existing research that attempts to identify the causes of the polarization effect also lacks methodological validity and reliability. Hence, there is a need to revise the base analysis method. Causality estimation based on quantile regression is far more difficult than with OLS regression. However, methods for quantile regression using longitudinal survey data or instrumental variables are being developed (Koenker et al. Eds. 2018). The authors of this study will actively work on clarifying causality using the appropriate methodologies.

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